

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
OFFICE OF QUALITY ASSURANCE**

AUDIT REPORT LBNL-ARP-99-06

OF

LAWRENCE BERKELEY NATIONAL LABORATORY

AT

BERKELEY, CALIFORNIA

APRIL 19 - 23, 1999

Prepared by: _____ **Date:** _____

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1.0 EXECUTIVE SUMMARY

This performance-based Quality Assurance (QA) Audit was conducted at Lawrence Berkeley National Laboratory (LBNL), Berkeley, California, April 19 - 23, 1999, to evaluate processes and controls associated with Work Packages (WP) 14012215M1 and 14012025M1, *Seepage Threshold Testing and 36Cl Analysis-SR-FY99*. In addition, selected QA program elements directly related to the WPs were evaluated for compliance to the QARD. The team determined that LBNL has effectively implemented critical process steps for the ongoing activities associated with Seepage Studies at the Niches and Flow in the Nonwelded Tuff: Preliminary results for the PTn at Alcove 4. The technical evaluation of the studies determined that the scientific work was of good technical quality. In addition, the audit team determined that the LBNL is effectively implementing the Office of Civilian Radioactive Waste Management (OCRWM) QA program in accordance with the U.S. Department of Energy (DOE) OCRWM Quality Assurance Requirements and Description (QARD) document, (DOE/RW-0333P), Revision 8; and LBNL's implementing procedures. QA program elements 1.0, 2.0, 4.0, 5.0, 6.0, 7.0, 12.0, 15.0, 16.0, 17.0, Supplements I, II, III, and V are effectively implemented. This satisfies OCRWM requirements to perform an annual compliance based audit. Currently elements 3.0, 8.0, 9.0, 10.0, 13.0, 14.0, 18.0, and Supplement IV are not implemented by LBNL.

Seven conditions adverse to quality were identified as a result of the audit: (1) Personnel reading assignments were missing dates; (2) an employment/experience form had an incorrect header; (3) document review/comment forms contained comment resolutions added after Project Manager sign-off; (4) equipment log book did not contain a calibration due date; (5) information contained in a Scientific Notebook (SN) Table of Contents for a QIP-2.1 Review Package was inaccurate; (6) Document Control Action Requests and controlled document instructions were not submitted to the records processing center; and (7) software configuration status accounting monthly reports and user requests were not submitted to the Records Processing Center (RPC) as nonpermanent QA records. These identified conditions required only remedial action and were corrected during the audit. Details of these conditions are presented in Section 5.5 of this report. The audit team also identified ten recommendations during the audit. These recommendations are detailed in Section 6.0 of this report.

2.0 SCOPE

The audit was conducted to evaluate the technical adequacy of LBNL WPs 14012215M1 and 14012025M1, *Seepage Threshold Testing and 36Cl Analysis-SR-FY99*. Specifically included in this evaluation was a determination of the effectiveness of critical process steps being implemented during preparation of the "Progress Report on Fracture Flow Drift Seepage and Matrix Imbibition Tests in the Exploratory Studies Facility," Revision 00.1, January 5, 1999. Chapter Two, "Flow Characterization and Drift Seepage Evaluation at

the Niches,” and Chapter Four, “Flow in the Nonwelded Tuff: Preliminary Results for the PTn at Alcove 4.”

The audit team conducted interviews and reviews of documentation to evaluate the adequacy of deliverables and effectiveness of critical process steps.

Process Steps/Products/Documentation

The performance-based evaluation was based upon the following:

1. Satisfactory completion of critical process steps
2. Acceptable results and quality of the end product
3. Documentation that substantiates the quality of product
4. Performance of trained and qualified personnel.
5. Implementation of applicable QA program elements

The following critical process steps were considered during the evaluation of the WP:

1. Scientific Investigation Planning
2. Identification, Traceability, and Control of Data
3. Data Analysis and Review
4. Control of Software
5. Control of References
6. Control of Scientific Notebooks
7. Control of Assumptions
8. Control of Measuring and Test Equipment
9. Independent Review of Study Results
10. Interface Controls
11. Identification, Traceability, and Control of Samples

Additionally, the audit evaluated the adequacy, compliance, and effectiveness of implementation of the OCRWM QA program at LBNL.

In accordance with the approved audit plan, the following QA program elements/requirements were evaluated:

QA Program Elements/Requirements

- | | |
|-----|---|
| 1.0 | Organization |
| 2.0 | QA Program |
| 4.0 | Procurement Document Control |
| 5.0 | Implementing Procedures |
| 6.0 | Document Control |
| 7.0 | Control of Purchased Items and Services |

12.0	Control of Measuring and Test Equipment
15.0	Nonconformances
16.0	Corrective Action
17.0	QA Records
Supp I	Software
Supp II	Sample Control
Supp III	Scientific Investigation
Supp V	Control of the Electronic Management of Data
Appendix C	Mined Geologic Disposal System

The following QA program elements were not reviewed during the audit since LBNL is not currently implementing them:

3.0	Design Control
8.0	Identification and Control of Items
9.0	Control of Special Processes
10.0	Inspection
11.0	Test Control
13.0	Handling, Storage, and Shipping
14.0	Inspection, Test and Operating Status
18.0	Audits
Supp IV	Field Surveying
Appendix A	High-Level Waste form Production
Appendix B	Storage and Transportation

3.0 AUDIT TEAM AND OBSERVERS

The following is a list of audit team members, their assigned areas of responsibility, and observers from the Nuclear Regulatory Commission (NRC) and OQA:

<u>Name/Title/Organization</u>	<u>QA Program Elements/Requirements</u>
Lester W. Wagner, Audit Team Leader, OQA	1.0, 15.0, 16.0, and Supplement I
Emily S. Jensen, Audit Team Leader-in-Training, OQA	1.0, 15.0, 16.0 and Supplement I
Patrick V. Auer, Auditor, OQA	Supplements II, III, and V
James C. Mattimoe, Auditor, OQA	2.0, 4.0, 7.0, 12.0, Appendix C
Donna J. Sinks, Auditor, OQA	2.0, 5.0, 6.0, 17.0
F. Harvey Dove, Technical Specialist, MTS	Technical Activities

Ted H. Carter, Observer, NRC
Jeffrey Ciocco, Observer, NRC
Jack Spraul, Observer, NRC
Albert C. Williams, Observer, OQA
Edward P. Opelski, Observer, OQA

4.0 AUDIT TEAM MEETINGS AND PERSONNEL CONTACTED

A pre-audit meeting was conducted at LBNL on April 19, 1999. Daily debriefings were held to apprise LBNL management and staff of the progress of the audit and any identified conditions adverse to quality. A post-audit meeting was conducted at LBNL on April 23, 1999.

Personnel contacted during the audit, including those that attended the pre-audit and post-audit meetings, are listed in Attachment 1.

5.0 SUMMARY OF RESULTS

5.1 Program Effectiveness

The audit team concluded that critical process steps applicable to WPs 14012025M1 and 14812215M1 were effectively implemented and that the QA program implemented at LBNL is effective for the scope of this audit.

The results for each critical process step and program element evaluated are contained in Attachment 2, Summary of Audit Results.

5.2 Stop Work or Immediate Corrective Action Taken

There were no Stop Work Orders, or immediate corrective actions taken as a result of the audit.

5.3 QA Program Implementation

A summary table of audit results is provided in Attachments 2 and 3. Details of the audit, including the objective evidence reviewed, are documented in the audit checklist. The checklist is maintained as a QA record.

5.4 Technical Audit Activities

Specifically included in the technical evaluation was a determination of the effectiveness of critical process steps being implemented during preparation of

two chapters of the LBNL draft document entitled “Progress Report on Fracture Flow Drift Seepage and Matrix Imbibition Tests in the Exploratory Studies Facility,” Revision 00.1, January 5, 1999. Five technical areas associated with LBNL fracture flow drift seepage and matrix imbibition tests were addressed using an audit checklist:

- Assumptions, Software, and Data;
- Flow Characterization and Drift Seepage Evaluation at the Niches (Chapter 2);
- Flow in Nonwelded Tuff: Preliminary Results for the PTn at Alcove 4 (Chapter 4);
- Draft Master Planning Document (MPD): Ambient Field Testing FY99; and
- Draft Master Planning Document (MPD): Drift Scale Modeling FY99.

The NRC Observer, Jeff Ciocco, provided four technical questions on an Audit Observer Inquiry Form. These questions were addressed during the audit and will be formally documented and transmitted to the NRC under a separate cover letter. The four questions/concerns are as follows:

1. Are the niche tests sufficient to represent slow steady seepage of the UZ Conceptual Model?
2. Why does the range of α (alpha) parameters used in seepage models not include the value determined from liquid release tests for the individual fractures, at least as an end-member?
3. Capillary barrier hypothesis may be minor for some individual vertical fractures with only slightly greater percolation flux than present day.
4. The simulation conclusions of 1 mm/yr as the appropriate ambient percolation rate may be grounded in the poor fitting Von Genuchten parameters.

5.4.1. Audit Process

Ten members of the LBNL staff working on the Yucca Mountain Project (YMP) were interviewed during the week. They were knowledgeable managers and technical staff, who demonstrated competence in the operations over which they were responsible.

Responses to checklist questions were supported by objective evidence as appropriate for clarification and documentation. Data tracking numbers (DTN) were selected and traced as objective evidence of LBNL operations at various stages in a sequential analysis. This was accomplished by using personal computers assigned to LBNL technical staff to access selected DTNs residing in the Technical Data Management System (TDMS). An

electronic trace of the DTN was initiated along with a real-time demonstration of the TDMS. The DTNs were selected from the two chapters of the LBNL draft document or as referenced in SNs. Traceability from SNs was not established to the data source. Traceability from the SNs to data source is being addressed in CAR LVMO-99-C-001.

The LBNL analytical laboratory, containing rock samples and water samples from the Exploratory Studies Facility (ESF) at Yucca Mountain, was evaluated for traceability of sample identification. Based on available documentation, all samples reviewed were traceable.

Documentation for several LBNL computer codes was evaluated. These codes were both acquired and developed computer software. ITOUGH2, Version 4.0, is considered an acquired code because LBNL did not develop it with funds from the YMP. LBNL codes will be placed under the control of AP-SI.1Q, *Software Configuration Management*, after LBNL proprietary questions are resolved.

Draft planning documents for additional field testing in the ESF, followed by drift-scale modeling developed during FY99, were reviewed. The draft LBNL plans were a work in process, but they presented an organized approach to defining and scheduling technical activities for both field and modeling efforts.

5.4.2 Audit Results

The understanding of the OCRWM QA requirements by the LBNL staff was significantly improved since the performance-based audit (LBNL-ARP-98-12) conducted on May 18 through 22, 1998. The quality, transparency, and traceability of documentation from LBNL SNs, to the TDMS, and to the LBNL reports were noteworthy and commendable. The attitude of the LBNL staff was helpful and cooperative throughout the audit process.

The LBNL SNs, reviewed during the audit, were acceptable. The entries were complete and up-to-date, and all the notebooks were identified through a master list maintained by the PI, Joe Wang.

Two technical concerns were identified during the conduct of the audit:

1. References in Chapters 2 and 4 of “Progress Report on Fracture Flow, Drift Seepage and Matrix Imbibition Tests in the Exploratory Studies Facility” (Revision 00.1, January 5, 1999) were inconsistent. For example, citations for U.S. Geological Survey (USGS) data listed for Flint, A.L., (1998); Flint, L.E., (1998); and Flint, L.E., (1997) (pages 4-42 and 4-43) were incomplete. The source of the data was not included in the reference citations.
2. The percentage of deep percolation that may seep into an emplacement drift is dependent on the scales of heterogeneity encountered in the subsurface geology of Yucca Mountain. The LBNL progress report concentrates on heterogeneities and fracture networks in approximately one foot test intervals and subsurface expressions of faults. The smaller scale features help to establish a technical basis for quantifying seepage thresholds in the immediate vicinity of the drift opening. In addition, they provide a technical basis for quantifying deep percolation that is considered to bypass the emplacement drifts (as a possible result of the capillary barrier effect). However, other intermediate scale features (smaller than faults) such as weeps may provide additional pathways for significant drift seepage.

It is important that the percentage of deep percolation flux that may seep into the emplacement drift be as low as can be technically justified. Uncertainty in this quantity may impact the design of the waste package and adversely affect the cost of the final repository. Additional subsurface testing is necessary to reduce uncertainty in the quantification of deep percolation that bypasses the emplacement drifts or may be introduced by fast-flow pathways (NRC acceptance criteria on deep percolation flux).

5.5 Summary of Conditions Adverse to Quality

The audit team identified seven deficient conditions that were corrected prior to the post-audit meeting.

5.5.1 Corrective Action Request (CAR)

None

5.5.2 Deficiency Reports (DR)

None

5.5.3 Performance Reports (PR)

None.

5.5.4 Deficiencies Corrected During the Audit (CDA)

Deficiencies which are considered isolated in nature and only requiring remedial action can be corrected during the audit. The following deficiencies were identified and corrected during the audit:

1. LBNL Procedure YMP-LBNL-QIP-2.1, Revision 3, Mod. 0, *Qualifying Personnel*, contains a Reading Assignment Statement (Attachment 5), for documenting reading assignments. The forms had been signed and dated by the employees; however, two of these forms were missing a date in the "Date Read" space. The employees were contacted and the missing dates were entered on the form.
2. LBNL Procedure YMP-LBNL-QIP 2.1, Revision 3, Mod. 0, *Qualifying Personnel*, requires Education and Experience to be documented on the YMP-LBNL Education and Experience Verification Record. The header and title for one Education and Experience Verification Record were incorrect. The form was corrected during the audit.
3. LBNL Procedure YMP-LBNL-QIP 6.1, Revision 4, Mod. 0, *Document Review*, requires the Program Manager's review, approval and signature on the Document Review/Comment Resolution Form after comment resolution. Non-mandatory technical comments were resolved after the Program Manager's approval and signature during technical review, concurrence and qualification of software routine Automated_dst, Revision 1.vi. This was corrected by the Program Manager's concurrence and signature of the resolved comments.
4. LBNL Procedure YMP-LBNL-QIP-12.0, Revision 3, Mod. 0, *Control and Calibration of Measuring & Test Equipment*, and QARD Section 12.2.7.E requires the recalibration due date to be documented in the equipment log book. One calibration due date was recorded in Scientific Notebook JSW-6 instead of the equipment log book. This was corrected by adding the missing date to the equipment log book.

5. YMP Procedure AP-17.1Q, Revision 0, ICN 2, *Record source Responsibilities for Inclusionary Records*, requires a Table of Contents (i.e., Records Package Table of Contents, Attachment 6, or equivalent) and include it as the first record in the record package. The reviewed and revised LBNL QARD Matrix for YMP-LBNL-QIP-2.1, R3-M0, had been misplaced. The records *package* for the review of the QIP did not include the QARD Matrix; therefore, the table of contents for records accession number MOL.19980706.0382 did not include the QARD Matrix. The Table of Contents for the records package was revised to include the QARD Matrix, and the misplaced QARD Matrix and the corrected Table of Contents were submitted for MOL.19980706.0382 on 4/21/99.
6. YMP Procedure AP-17.1Q, Revision 0, ICN 2, *Record Source Responsibilities for Inclusion Records*, requires individual records to be submitted to the RPC either by transmittal or by secondary distribution within 90 calendar days of completion. Records required by YMP-LBNL-QIP-6.0, R1-M1 (Document Control Action Requests and Controlled Document Instructions) were not submitted to the RPC within the allotted time frame. Four records packages containing a total of 1319 Document Action Requests and Controlled Document Instructions were compiled and submitted to the RPC.
7. LBNL Procedure YMP-LBNL-QIP-SI.1, Revision 1, Mod. 0, *Software Configuration Management*, (now obsolete) required Software Configuration Status Accounting Monthly Reports and User Requests to be submitted to the RPC as nonpermanent QA records. None of the monthly reports or user requests had been submitted to the RPC. This was corrected during the audit by transmitting the necessary nonpermanent records to the RPC.

5.5.5 Follow-up of Previously Issued Deficiency Documents

Follow-up of Deficiency Report (DR) LBNL-98-D-029 was performed during the audit. The DR identified that technical procedures were documented in SNs instead of in Technical Implementing Procedures (TIP) and that SNs used for studies were not reviewed during technical reviews of the milestone reports. This DR was satisfactorily verified and closed by the OQA on 10/20/98. No other instances of this condition were identified during the audit.

Follow-up of DR LBNL-98-D-030 was performed during the audit. The DR identified that LBNL failed to obtain sign-offs of mandatory comments on technical documents. Although actions to preclude recurrence (procedure revision) have occurred, this DR will remain open pending completion of CAR LVMO-99-C-001 actions relative to LBNL. No other instances of this condition were identified during the audit.

Follow-up of DR LBNL-98-D-031 was performed during the audit. This DR documented that LBNL had not established minimum experience requirements for personnel work subject to QARD requirements. This DR was satisfactorily verified and closed by the OQA on 9/18/98. No other instances of this condition were identified during the audit.

Follow-up of DR LBNL-98-D-032 was performed during the audit. This DR documented that the LBNL Requirements Matrix was incomplete and out-of-date. This DR was satisfactorily verified and closed by the OQA on 7/13/98. No other instances of this condition were identified during the audit.

Follow-up of DR LBNL-98-D-033 was performed during the audit. This DR documented that the Acoustic Emissions equipment was calibrated by a supplier not on the Qualified Suppliers List (QSL) and the Ground Penetrating Radar equipment was not calibrated. This DR was satisfactorily verified and closed by the OQA on 9/8/98. No other instances of this condition were identified during the audit.

Follow-up of DR LBNL-98-D-034 was performed during the audit. This DR documented that the LBNL had not cancelled their procedure YMP-LBNL-QIP-17.0, Revision 1, MOD 0, *Submitting Records to the YMP-LBNL Records Processing Center*, and implemented YMP Procedure AP-17.1Q, *Record Source Responsibilities for Inclusionary Records*. This DR was satisfactorily verified and closed by the OQA on 7/21/98. No other instances of this condition were identified during the audit.

Follow-up of DR LBNL-98-D-035 was performed during the audit. This DR documented that LBNL software procedures do not provide sufficient detail to translate QARD requirements into work processes. This DR was satisfactorily verified and closed by the OQA on 11/30/98. No other instances of this condition were identified during the audit.

6.0 RECOMMENDATIONS

The following recommendation resulted from the audit and will require a formal response:

1. It is recommended that records submittal requirements in Quality Implementing Procedures (QIP) and TIPs be clarified by identifying which documents are individual records or part of records packages, to be submitted to the RPC.

The following additional recommendations resulted from the audit and are presented for CRWMS M&O and LBNL management consideration:

2. It is recommended that the role of planning and technical preparers be included in LBNL Procedure YMP-LBNL-QIP-5.2 for Master Planning Documents; show where coordination with other organizations in the planning effort is conducted.
3. It is recommended that the LBNL staff understand the difference between mandatory and non-mandatory review comments.
4. It is recommended that an adequate time frame between document approval and effective date is provided to allow for training and distribution of controlled documents.
5. It is recommended that the LBNL staff coordinate with the OQA Representative to determine if potential conditions adverse to quality warrant formal documentation in accordance with YMP procedure AP-16.1Q.
6. It is recommended that the LBNL staff evaluate QIPs, TIPs and MPDs for appropriate personnel to be on controlled distribution because of the recent revision of LBNL Procedure YMP-LBNL-QIP 6.0, effective 4/19/99.
7. It is recommended that the use of and reference to sample and equipment log books in SNs and QIPs be clarified.
8. It is recommended that the reporting of LBNL calibrations be standardized. This would easily facilitate meeting the requirements of the soon to be issued YMP Procedure YAP-12.3Q, *Control of M&TE*.
9. It is recommended that the CRWMS M&O provide consistent guidance on reference citations (particularly data citations) to report authors in writing. The LBNL staff indicated that guidance on reference citations were verbal and inconsistent. Guidance on report format, including important reference citations, should be provided early in the report preparation process.

10. It is recommended that management strongly consider the NRC acceptance criteria for deep percolation (particularly Criterion #3) in the design of any future subsurface testing activities to quantify drift seepage. This criterion may directly affect the cost of the repository and/or may affect the ability to establish reasonable assurance in the License Application.

NRC Issue Resolution Status Report, Key Technical Issue: Unsaturated and Saturated Flow Under Isothermal Conditions, Revision 1, Volume I, September 1998, Item 5.4, Deep Percolation (Present and Future), Page 153, Criterion #3, first paragraph:

“It will be acceptable for DOE to conservatively assume that the fraction of deep percolation that intercepts disposal drifts also drips onto the waste packages. Technical bases should be provided for deep percolation that is considered to bypass emplacement drifts. These technical bases should use field observations, experimental data from the ESF facility, calculations based on mass balance, tracer studies, and data from natural analog sites. Likely changes in percolation rates and patterns due to climate change should also be considered. Also, the abstracted model used in PA should be tested against more detailed models and field observations to assure that it produces reasonably conservative dose estimates. It is known that the amount of deep percolation into the waste emplacement drifts is sensitive to fast flow in fracture zones. Such flow paths need to be considered in DOE’s calculations.”

7.0 LIST OF ATTACHMENTS

Attachment 1: Personnel Contacted During the Audit
Attachment 2: Summary Table of Audit Results

ATTACHMENT 1

Personnel Contacted During the Audit

<u>Name</u>	<u>Organization/Title</u>	<u>Pre-audit Meeting</u>	<u>Contacted During Audit</u>	<u>Post-audit Meeting</u>
Aden-Gleason, Nancy	LBNL EA Manager	X	X	X
Bodvarsson, Bo	LBNL Program Manager	X	X	X
Cook, Paul	LBNL Research Associate		X	
Cushey, Mark	LBNL Staff Scientist, PI		X	X
Cuzner, Marlene	LBNL Document Control and Records Coordinator		X	X
Fissekidou, Vivi	LBNL EA Specialist	X	X	X
Freifeld, Barry	LBNL Mechanical Engineer		X	
Goldstein, Norman	LBNL ESD Deputy Director			X
Harris, Stephen	OQA/Site Representative	X	X	X
Hinds, Jennifer	LBNL Principal Investigator		X	
Hu, Max	LBNL Staff Scientist		X	
Jackson, June	LBNL Records Clerk		X	X
Lau, Peter	LBNL Procurement Coordinator			X
Link, Suzanne	LBNL Technical Data Coordinator		X	X
Mangold, Don	LBNL Software Conf. Manager	X	X	X
McClung, Ivelina	LBNL Administrative Asst.			X
Oldenburg, Curtis	LBNL Staff Scientist	X	X	
Salve, Rohit	LBNL Research Associate	X		X
Simmons, Ardyth	LBNL Program Manager		X	
Trautz, Robert	LBNL Staff Resident Associate		X	X
Tsang, Yvonne	LBNL Senior Scientist, PI	X		
Wang, Joseph	LBNL Staff Scientist, PI	X	X	X

ATTACHMENT 2

SUMMARY TABLE OF AUDIT RESULTS

Product	Critical Process Steps	Details (Checklist)	Recommendation	Process Effectiveness	Product Adequacy	Overall
Work Package	Scientific Investigation Planning	Pgs. 72, 77-104, 105, 107	RECs #1 & #10	SAT	SAT	SAT
	Identification Traceability and Control of Data	Pgs. 37, 38, 88-89, 91-95, 100, 104, 108		SAT	SAT	SAT
	Data Analysis and Review	Pgs. 71, 75, 97		SAT	SAT	SAT
	Control of Software	Pgs. 36, 37, 69, 106		SAT	SAT	SAT
	Control of References	Pgs. 73, 75-76, 100	REC #9	SAT	SAT	SAT
	Control of Scientific Notebooks	Pgs. 80-88, 101, 107		SAT	SAT	SAT
	Control of Assumptions	Pgs. 35, 74, 76		SAT	SAT	SAT
	Control of Measuring & Test Equipment	Pgs. 69-70	REC #8	SAT	SAT	SAT
	Independent Review of Study Results	Pgs. 98-99	REC #3	SAT	SAT	SAT
	Interface Controls	Pgs. 14-16	REC #2	SAT	SAT	SAT
	Identification, Traceability and Control of Samples	Pgs. 61-68		SAT	SAT	SAT

LEGEND:

SAT.....Satisfactory

ATTACHMENT 3

SUMMARY TABLE OF AUDIT RESULTS

QARD Element	Implementing Document	Details (Checklist)	CDA	Recommendation	Process Adequacy	Product Adequacy	Overall
1.0	YMP-LBNL-QIP-1.0, Rev. 3	Pg. 1			SAT	SAT	SAT
2.0	YMP-LBNL-QIP-2.1, Rev. 3 QIP-5.2, Rev. 2	Pgs. 2-8	CDA #1 & #2		SAT	SAT	SAT
4.0 & 7.0	QIP-4.0, Rev. 3 QIP-4.1, Rev. 2	Pgs. 9-13			SAT	SAT	SAT
5.0	QIP-5.2, Rev. 2	Pgs. 14-16		REC #2	SAT	SAT	SAT
6.0	AP-6.1Q, Revs. 1 and 2 QIP-6.0, Rev. 1, Mod. 1 QIP-6.1, Rev. 4	Pgs. 17-21	CDA #3	RECs #3, #4 & #6	SAT	SAT	SAT
12.0	QIP-12.0, Rev. 1	Pgs. 22-27	CDA #4	REC #8	SAT	SAT	SAT
15.0	YAP-15.1Q	Pg. 28			SAT	SAT	SAT
16.0	AP-16.1Q, Rev. 3 AP-16.2Q	Pgs. 29-32		REC #5	SAT	SAT	SAT
17.0	AP-17.1Q	Pgs. 33-34	CDA #5 & #6	REC #1	SAT	SAT	SAT
SUPP. I	QIP-SI.1, Rev. 1 AP-SI.1Q, Rev. 0 QIP-SI.0, Rev. 4, Mod. 1	Pgs. 39-60	CDA #7		SAT	SAT	SAT
SUPP. II	QIP-SII.0, Rev. 1	Pgs. 61-68			SAT	SAT	SAT
SUPP. III	QIP-SIII.0, Rev. 3 QIP-SIII.3, Rev. 1 AP-3.10Q, Rev. 0 AP-3.1Q, Rev. 0	Pgs. 77-97		RECs #7, #9 & #10	SAT	SAT	SAT
SUPP. V	YAP-SV.1Q, Rev. 0	Pg. 108			SAT	SAT	SAT